

Amendment and Response

Applicant: David C. Collins et al.

Serial No.: 10/821,135

Filed: April 8, 2004

Docket No.: 200400517-1

Title: GENERATING AND DISPLAYING SPATIALLY OFFSET SUB-FRAMES

IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of the claims:

1. (Currently Amended) A method of displaying an image with a display device, the method comprising:
 - receiving image data for the image, the image data comprising a first set of pixels;
 - generating first and second sub-frames, wherein the first and the second sub-frames comprise a second set of pixels, wherein each of the second set of pixels is centered relative to a respective one of the first set of pixels; and
 - alternating between displaying the first sub-frame in a first position and displaying the second sub-frame in a second position spatially offset from the first position.
2. (Original) The method of claim 1 further comprising:
 - generating third and fourth sub-frames, wherein the third and the fourth sub-frames comprise the second set of pixels, wherein each of the second set of pixels is centered relative to one of the first set of pixels; and
 - alternating between displaying the first sub-frame in the first position, displaying the second sub-frame in the second position spatially offset from the first position, displaying the third sub-frame in a third position spatially offset from the first position and the second position, and displaying the fourth sub-frame in a fourth position spatially offset from the first position, the second position, and the third position.
3. (Original) The method of claim 2 further comprising:
 - generating a simulated image by convolving the first, the second, the third, and the fourth sub-frames with an interpolating filter.
4. (Original) The method of claim 3 wherein the interpolating filter comprises a 3x3 interpolating filter with nine filter coefficients.

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5. (Original) The method of claim 4 wherein the nine filter coefficients comprise first, second, and third rows which each comprise three coefficients, wherein the three coefficients of the first row have values of $1/16$, $2/16$, and $1/16$, respectively, wherein the three coefficients of the second row have values of $2/16$, $4/16$, and $2/16$, respectively, and wherein the three coefficients of the third row have values of $1/16$, $2/16$, and $1/16$, respectively.

6. (Original) The method of claim 4 wherein the nine filter coefficients comprise first, second, and third rows which each comprise three coefficients, wherein the three coefficients of the first row have values of 0, $1/8$, and 0, respectively, wherein the three coefficients of the second row have values of $1/8$, $4/8$, and $1/8$, respectively, and wherein the three coefficients of the third row have values of 0, $1/8$, and 0, respectively.

7. (Original) The method of claim 3 further comprising:
generating an error image by subtracting the simulated image from the image data.

8. (Previously Presented) The method of claim 7 further comprising:
generating first, second, third, and fourth correction sub-frames from the error image;
and
generating fifth, sixth, seventh, and eighth sub-frames by adding the first, the second, the third, and the fourth correction sub-frames to the first, the second, the third, and the fourth sub-frames, respectively.

9. (Original) The method of claim 3 further comprising:
generating an error image by subtracting the simulated image from the image data to generate error data and by convolving the error data with an error filter.

10. (Original) The method of claim 9 wherein the error filter comprises a 3×3 error filter with nine filter coefficients.

11. (Original) The method of claim 10 wherein the nine filter coefficients comprise first, second, and third rows which each comprise three coefficients, wherein the three coefficients

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of the first row have values of $1/16$, $2/16$, and $1/16$, respectively, wherein the three coefficients of the second row have values of $2/16$, $4/16$, and $2/16$, respectively, and wherein the three coefficients of the third row have values of $1/16$, $2/16$, and $1/16$, respectively.

12. (Previously Presented) The method of claim 9 further comprising:
generating first, second, third, and fourth correction sub-frames from the error image;
and
generating fifth, sixth, seventh, and eighth sub-frames by adding the first, the second, the third, and the fourth correction sub-frames to the first, the second, the third, and the fourth sub-frames, respectively.
13. (Currently Amended) A system for displaying an image, the system comprising:
a buffer adapted to receive image data for the image, the image data comprising a first set of pixels;
an image processing unit configured to define first, second, third, and fourth sub-frames comprising a second set of pixels, wherein each of the second set of pixels is centered on a respective one of the first set of pixels; and
a display device adapted to alternately display the first sub-frame in a first position, the second sub-frame in a second position spatially offset from the first position, the third sub-frame in a third position spatially offset from the first position and the second position, and the fourth sub-frame in a fourth position spatially offset from the first position, the second position, and the third position.
14. (Original) The system of claim 13 wherein the first set of pixels comprise a plurality of pixels at a first resolution, and wherein the second set of pixels comprise a plurality of pixels at a second resolution less than the first resolution.
15. (Original) The system of claim 13 wherein the image processing unit is configured to generate a third set of pixels for a simulated image by convolving each of the second set of pixels with at least four other pixels from the second set of pixels.

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16. (Original) The system of claim 15 wherein the image processing unit is configured to generate an error image by subtracting the simulated image from the image data, and wherein the image processing unit is configured to generate fifth, sixth, seventh, and eighth sub-frames using the error image and the first, the second, the third, and the fourth sub-frames.

17. (Original) The system of claim 16 wherein the image processing unit is configured to generate first, second, third, and fourth correction sub-frames from the error image, wherein the image processing unit is configured to generate the fifth, the sixth, the seventh, and the eighth sub-frames by multiplying each of the first, the second, the third, and the fourth correction sub-frames by a sharpening factor and adding the first, the second, the third, and the fourth sub-frames to the first, the second, the third, and the fourth correction sub-frames, respectively.

18. (Original) The system of claim 15 wherein the image processing unit is configured to generate a plurality of error data values by subtracting the simulated image from the image data, wherein the image processing unit is configured to generate an error image by convolving each of the error data values with eight adjacent error data values, and wherein the image processing unit is configured to generate fifth, sixth, seventh, and eighth sub-frames using the error image and the first, the second, the third, and the fourth sub-frames.

19. (Original) The system of claim 18 wherein the image processing unit is configured to generate first, second, third, and fourth correction sub-frames from the error image, wherein the image processing unit is configured to generate the fifth, the sixth, the seventh, and the eighth sub-frames by multiplying each of the first, the second, the third, and the fourth correction sub-frames by a sharpening factor and adding the first, the second, the third, and the fourth sub-frames to the first, the second, the third, and the fourth correction sub-frames, respectively.

20. (Currently Amended) A system for generating first, second, third, and fourth sub-frames for display at spatially offset positions to generate the appearance of an image, the system comprising:

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means for receiving image data corresponding to the image;

means for generating the first, the second, the third, and the fourth sub-frames using the image data, each of the first, second, third, and fourth sub-frames comprising a plurality of sub-frame pixel values that correspond to a plurality of sub-frame pixels wherein each of the plurality of sub-frame pixels ~~that~~ are centered with respect to a respective one of a plurality of pixels of the image data;

means for calculating a plurality of simulated image pixel values for a simulated image by convolving each of the sub-frame pixel values with at least four other sub-frame pixel values; and

means for updating the first, the second, the second, the third, and the fourth sub-frames in accordance with a difference between the simulated image and the image data.

21. (Previously Presented) The system of claim 20 further comprising:
means determining the difference between the simulated image and the image data.

22. (Canceled)

23. (Original) The system of claim 20 wherein the means for calculating includes means for calculating the plurality of simulated image pixel values for the simulated image by convolving each of the sub-frame pixel values with at least eight other sub-frame pixel values.

24. (Previously Presented) The system of claim 23 further comprising:
means for generating a plurality of error data values by subtracting the plurality of simulated image pixel values from the image data; and
means for calculating a plurality of correction pixel values for an error image by convolving each of the error data values with at least eight other error data values.

25. (Previously Presented) The system of claim 24 further comprising:
means for updating the first, the second, the second, the third, and the fourth sub-frames by generating fifth, sixth, seventh, and eighth sub-frames from the error image and a

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sharpening factor and adding the fifth, the sixth, the seventh, and the eighth sub-frames to the first, the second, the third, and the fourth sub-frames, respectively.

26. (Currently Amended) A computer-readable medium having computer-executable instructions for performing a method of generating sub-frames for display at spatially offset positions to generate the appearance of an image, comprising:

receiving image data corresponding to the image;

generating first, second, third, and fourth sub-frames based on the first image such that each pixel in each of the first, the second, the third, and the fourth sub-frames is centered with respect to a ~~corresponding~~ corresponding-respective pixel in the first image;

generating a simulated image by convolving the first, the second, the third, and the fourth sub-frames with an interpolating filter that comprises a first set of filter coefficients; and

updating the first, the second, the third, and the fourth sub-frames in accordance with a difference between the simulated image and the first image.

27. (Previously Presented) The computer-readable medium of claim 26 wherein the first set of filter coefficients comprise first, second, and third rows which each comprise three coefficients, wherein the three coefficients of the first row have values of $1/16$, $2/16$, and $1/16$, respectively, wherein the three coefficients of the second row have values of $2/16$, $4/16$, and $2/16$, respectively, and wherein the three coefficients of the third row have values of $1/16$, $2/16$, and $1/16$, respectively.

28. (Previously Presented) The computer-readable medium of claim 26 wherein the first set of filter coefficients comprise first, second, and third rows which each comprise three coefficients, wherein the three coefficients of the first row have values of 0, $1/8$, and 0, respectively, wherein the three coefficients of the second row have values of $1/8$, $4/8$, and $1/8$, respectively, and wherein the three coefficients of the third row have values of 0, $1/8$, and 0, respectively.

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29. (Original) The computer-readable medium of claim 26 having computer-executable instructions for:

generating an error image by subtracting the simulated image from the image data.

30. (Previously Presented) The computer-readable medium of claim 29 having computer-executable instructions for:

generating first, second, third, and fourth correction sub-frames from the error image;
and

generating fifth, sixth, seventh, and eighth sub-frames by adding the first, the second, the third, and the fourth correction sub-frames to and the first, the second, the third, and the fourth sub-frames, respectively.

31. (Original) The computer-readable medium of claim 26 having computer-executable instructions for:

generating an error image by subtracting the simulated image from the image data to generate error data and by convolving the error data with an error filter.

32. (Previously Presented) The computer-readable medium of claim 31 wherein the error filter comprises an error filter with a second set of filter coefficients, wherein the second set of filter coefficients comprise first, second, and third rows which each comprise three coefficients, wherein the three coefficients of the first row have values of $1/16$, $2/16$, and $1/16$, respectively, wherein the three coefficients of the second row have values of $2/16$, $4/16$, and $2/16$, respectively, and wherein the three coefficients of the third row have values of $1/16$, $2/16$, and $1/16$, respectively.

33. (Previously Presented) The computer-readable medium of claim 31 having computer-executable instructions for:

updating the first, the second, the second, the third, and the fourth sub-frames by generating fifth, sixth, seventh, and eighth sub-frames from the error image and adding the fifth, the sixth, the seventh, and the eighth sub-frames to the first, the second, the third, and the fourth sub-frames, respectively.